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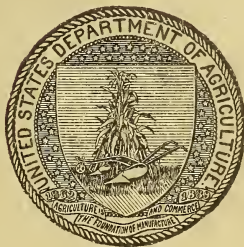
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No. 415.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.

INSTRUCTIONS TO
SPECIAL
RIVER AND RAINFALL OBSERVERS
OF THE WEATHER BUREAU.

PUBLISHED BY AUTHORITY OF THE
SECRETARY OF AGRICULTURE.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1909.





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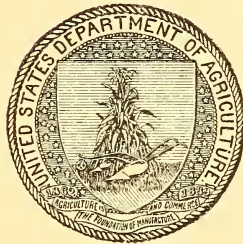
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NOTE TO SPECIAL RIVER AND RAINFALL OBSERVERS.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., August 1, 1909.

The accompanying Instructions to Special River and Rainfall Observers, Weather Bureau, are published for the information of all concerned.

WILLIS L. MOORE,
Chief, U. S. Weather Bureau.

NOTE.—This book should be kept *neat* and *clean*. When an observer is relieved, or is temporarily absent from his station, he will turn over these instructions to his successor, obtaining his receipt for the same, and will please forward this receipt, by mail, to the observer in charge of the district.

INSTRUCTIONS
FOR
SPECIAL RIVER AND RAINFALL OBSERVERS.

OBJECT OF RIVER AND RAINFALL OBSERVATIONS.

The river and rainfall stations of the Weather Bureau are maintained primarily for the purpose of giving warning of the approach, magnitude, and duration of high waters, and for forecasting water stages at all heights, in the interest of navigation on the inland waterways of the country. The river and precipitation data are also of great value to various other interests, particularly to those concerned with the problems of irrigation and water supply.

DISTRICT CENTERS.

For the better supervision and control of the work, the special stations are arranged in districts. These districts are under the direction of officials at regular meteorological stations of the Weather Bureau (designated the district centers), and are usually at the lower end of the district.

All correspondence relating to the work of substations, the furnishing of supplies, renewal of gages, settling of accounts, employment of observers, etc., is conducted through the official in charge at the district center to which the station is assigned.

Observers are furnished with penalty envelopes for correspondence with the district center and with the Central Office in Washington, D. C. No postage is required on letters regarding the work of the station when inclosed in penalty envelopes.

Persons accepting positions as special river and rainfall observers of the Weather Bureau become authorized agents of the United States, and are amenable to the laws in case of neglect of duty.

River gages are constructed at the expense of the United States, except where in cases previous to the establishment of river stations, there are gages already in existence, the property of municipalities, counties, townships, or corporations, in which cases there will, as a rule, be no gages erected if permission can be obtained to use those already installed.

Duplication of gages will be avoided when possible, both in the interest of economy, and to prevent confusion arising from double records of stages.

The records of stages are carefully preserved at Washington and printed from time to time. They are accessible to interested persons at all times.

SUPPLIES.

Supplies of blank forms, franked and addressed envelopes, rain gages, measuring sticks, etc., are furnished to observers upon application to the official in charge of the district center. Timely requisition will be made for such supplies as are needed, and the needs of the station must be so anticipated as to allow ample time for the delivery of the articles from the Central Office at Washington, D. C., through the district center. One month is sufficient for this.

INSTRUCTIONS.

The duties of a river observer consist in noting on a form furnished for the purpose—

First. The height of water on the gage, with change in twenty-four hours.

Second. Depth of rain or melted snow, with times of beginning and ending.

Third. Actual depth of snow, if any, since last observation.

Fourth. Direction of wind.

Fifth. State of weather.

Sixth. Depth of snow, if any, on ground on 15th and last day of month; also date on which last snow of season disappeared.

A postal card containing a record of the observations is also mailed daily, when required, to the official in charge of the district center.

A postal card (Form 1049, Met'l) containing the *original* record of the daily stages of water in the river is mailed on the last day of each month to the Chief, U. S. Weather Bureau, Washington, D. C.

Telegraphic reports are also made under certain conditions as hereinafter set forth.

The duties of a rainfall observer consist in noting on a form furnished for the purpose—

First. The depth of rain or melted snow, with times of beginning and ending.

Second. Actual depth of snow, if any, since last observation.

Third. Direction of wind.

Fourth. State of weather.

Fifth. Depth of snow, if any, on ground on 15th and last day of month.

A postal card containing a record of the observations is also mailed daily, when required, to the official in charge of the district center.

Telegraphic reports are also made under certain conditions, as hereinafter set forth.

All reports will be rendered to the officials in charge of the district centers, who will disseminate the information so as to best subserve the interests of the public.

The height of water on the gage should be noted to the nearest tenth of a foot each day, including Sundays and holidays.

This can only be done accurately when the water is placid; in a rough or turbulent stream, or when there is much wind, the waves prevent an accurate reading. In such a case the tenths must be estimated as near as possible, by taking the average of the highest and lowest marks on the gage which the water is seen to touch.

The depth of rain or of melted snow, or of melted snow and rain, must be given in inches and hundredths of an inch, properly separated by a decimal point.

A measurement of the actual depth of the snowfall since last observation must always be made and entered in inches and tenths of an inch.

In addition to measuring the depth of snowfall since the last observation, a measurement should be made of the actual depth in inches and tenths of an inch of the accumulated snow on the ground at the time of the observation, on the 15th and last day of the month.

It is desired, if it can be readily determined, that the observer report in the space on the form prepared for that purpose the date on which the last snow of the season disappeared.

Full instructions as to the method used to obtain the above data will be found under the head of "To measure rainfall or snowfall."

The direction of wind will be designated by the eight principal points of the compass, viz: N., NE., E., SE., S., SW., W., and NW., legibly written. When there is no wind the word "Calm" should be recorded.

The state of weather will be determined and recorded with reference to the degree of cloudiness, and whether or not precipitation is falling or likely to fall soon; thus when the sky is three-tenths or less covered with clouds, record "Clear;" four to seven tenths, inclusive, "Partly cloudy;" eight to ten tenths, "Cloudy;" and "Sprinkling," "Light rain," "Heavy rain," "Light snow," "Heavy snow," "Sleet," "Hailing," "Threatening," "Clearing," when these conditions exist. When light fog, light haze, or light smoke is observed with no clouds, the state of the weather will be recorded as "Clear."

Any unusual occurrences connected with the stages of the water in the river, such as the presence of floating ice, timber, etc., formation and breaking up of ice gorges and other obstructions, also thunderstorms, hailstorms, tornadoes, and earthquakes, should be noted.

Observers should, when possible, have substitutes capable of performing all the duties of a river observer, in order that there may be no interruption of the work in case of sickness or unavoidable absence from the station on the part of the regular observer. Members of the observers' families are very often instructed in the work.

TIME OF OBSERVATION.

The observation of the river stage will be made daily at 8 a. m., 75th meridian time, except when otherwise directed.

In all cases the 75th meridian time of observation should be given in the proper space at the head of the form, whether 8 a. m. or some other time.

The observations in feet and tenths of a foot will be written in the first column of the monthly blank form.

When the stage is below the zero of the gage it will be written in the form with a minus (—) sign before it.

The rise or fall will be given in the proper column on the form in feet and tenths of a foot. When the change is a fall it should have the minus (—) sign placed before it.

SPECIAL OBSERVATIONS.

Special observations of the stage of water will be made at other times of the day than 8 a. m. when requested by the official in charge of a district center or by the Central Office in Washington, or when the river is near, at, or above the flood stage.

It is desirable to have a special observation of the highest stage reached by the water in the case of the very great rises, without any request from a district center. In many cases the stage in a rise will reach in the course of the day several feet above the 8 a. m. stage and fall several feet before the time of the next regular observation on the day following.

When the rise in a river is very sudden and great, and, in the judgment of the observer, dangerous to points below, the stage will be telegraphed to the district center and to the places most interested in the information, according to such special instructions as may be given to each observer.

Special observations will contain exactly the same information as a regular report, but the rainfall after being measured should not be emptied out of the gage, but left therein until the next regular observation, when, after measuring, it will be poured out.

RIVER GAGE.

A river stage is the vertical height of the water surface in feet above some definite plane, the zero of the gage usually, at, or somewhere near, the level of the lowest water that has occurred. A river gage is a device for observing the river stage.

When possible without too great expense, river gages are made vertical. They consist of a plank or planks, usually 2 inches thick and 8 to 12 inches wide, fastened to a bridge pier or piling or other structure, and of sufficient length to cover the greatest range in height of water ever likely to occur. The planks are graduated to feet and tenths, and the height of the surface of the water in the river can be read on it by estimation to the nearest tenth of a foot.

Sometimes river gages consist of a strip of the surface of a stone pier dressed smooth so as to receive the necessary marking and numbering.

When a river gage can not be set vertically, it is laid along the bank according to the slope of the ground. It should then be made of heavy timbers, at least 6 by 6 inches, and preferably of oak, hard pine, or Oregon fir, embedded in the ground, with the top surface even with the surface of the ground on the river bank. Strap iron $\frac{1}{4}$ inch thick and 2 inches wide, is spiked along the top and upstream sides, and on the toppiece are cut the foot and intermediate marks. The even foot marks are also indicated by figures, in brass or paint, on the timber. The foot marks on a gage of this kind must be accurately located by a civil engineer.

Very substantial inclined gages are made of concrete or lengths of block stone, with bars of railroad iron inlaid, on which the foot marks are cut.

It is not always possible at the time of setting a gage to put the zero of graduation at the exact level of the lowest water apt to occur, or the lowest that has occurred in a long period of years. In such cases the gage should be finished as far down as possible, and completed when the water falls sufficiently low.

When a stage of water below the zero occurs it is read as a minus stage. It is desirable that the zero should be put so low that this will never occur, as the minus sign is apt to lead to confusion. The bed of the river channel usually makes the best zero mark.

When a gage is once established and a long record of readings made, it is not advisable to make any change in its zero on any pretext whatever, even if a stage lower than any ever before known should occur.

For the purpose of ascertaining from time to time any changes that may occur in the level of the zero of a gage or any of its marks, a bench mark should be established close by the gage or somewhere in its vicinity. A bench mark consists of some accessible, presumably permanent, point or surface, the difference in level between which and the zero or some other mark on the gage is known by actual leveling between the two. When this difference is found to vary it is presumed it indicates a corresponding change in the level of the marks of the gage, requiring either adjustment of the gage or correction of its readings.

A bench mark is essential in case a river gage is to be repaired or renewed, in order that the new gage may be set at exactly the same level as it was before. On a bridge pier the top surface of the largest stone accessible in the top course of masonry is often used as a bench mark. Sometimes a bench mark is the top surface of a large stone buried in the ground specially for the purpose of establishing a permanent surface. Prominent surfaces in stone buildings are good places for permanent bench marks. A copper bolt, or metal plate, set in the stone wall of some public building, such as the custom-house, post-office, or city hall, is a common device for a bench mark in a large city.

The river gages used by the Weather Bureau are partly shown in figs. 1, 2, 3, and 4. The design best adapted to any particular location will be used in each case.

The specifications to be followed in procuring bids for the construction of these gages are as follows:

SPECIFICATIONS FOR RIVER GAGE SHOWN IN FIG. 1.

The river gage will be made of sound pine or oak timber, free from knots or shakes, 2 inches in thickness, 12 inches in width, and of such a length as to extend, if possible, from 2 or more feet below the zero point to about 5 feet above the highest known water. The face of the plank upon which the graduations are to be made, and the top, bottom, and sides, will be planed smooth, and will receive two coats of the best white-lead paint. The face will then be graduated as follows:

Commencing at the point which will correspond to the zero, graduate the gage both above and below that point in feet and tenths of feet.

The graduations will be chiseled or burnt into the wood to the depth of about one-eighth of an inch and then given two coats of the best black paint. The marks for even feet will extend entirely across the face of the gage; those for half-feet one-half the distance across, beginning on the left side, and those for the intermediate graduations one-fourth of the distance across, beginning on the left side. Even feet will also

be shown by the appropriate figures, 6 inches in height, on the right side of the gage, and so placed that the marks for even feet will exactly bisect the figures. The figures will also be chiseled or burnt into the wood to the depth of about one-eighth of an inch, and then given two coats of the best black paint. The legend,



Fig. 1.

U. S. Weather Bureau, should be painted in black across the top of the gage.

Having graduated the gage, select a pile or other stationary object on some portion of the levee, wharf, or bank where the gage will be secure from injury. Lower the gage into the water, taking care to keep it in a vertical position until it touches the bed of the river or its zero is the point of lowest water; then securely fasten it by spikes or bolts.

SPECIFICATIONS FOR RIVER GAGE SHOWN IN FIG. 2.

Procure a piece of pine, cypress, or oak timber about 6 by 6 inches, and of sufficient length to cover the full range of the river between extreme low and high water marks. This timber will be placed in

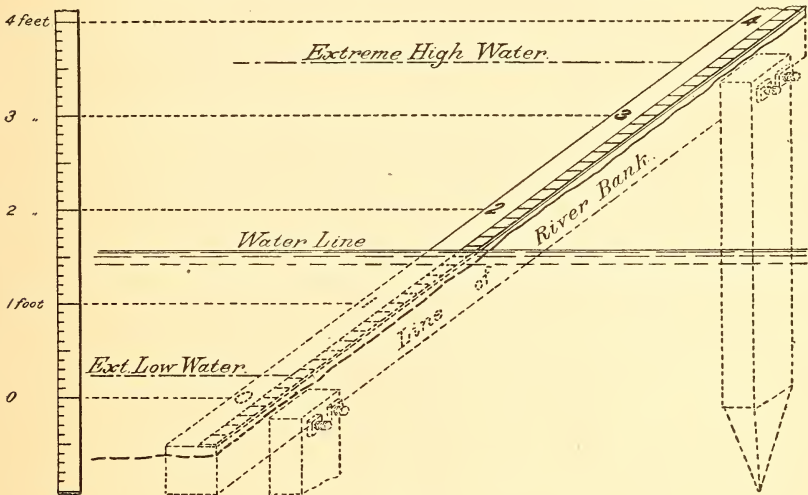


FIG. 2.

the river bank, firmly embedded in the earth, leaving $1\frac{1}{2}$ inches exposed above the level of the ground.

To secure this form of gage thoroughly it will be necessary to attach it to 4 by 6 or 6 by 6 inch oak, cedar, locust, or fir posts, driven 6 feet into the ground, and placed 6 feet apart. The upper edge of the gage should be planed smooth, and a strap of iron, $\frac{1}{4}$ by 2 inches screwed along the top on the upstream side, and graduated in feet and tenths of feet, after being placed in position, taking the point of lowest water, or that which has been selected as the zero of the scale, and locating the feet and tenths both above and below that point. The graduations for this gage will be the same as for the gage shown in fig. 1. Especial pains should be taken in graduating the gage to see that the distances marked off upon it for each foot and its subdivisions correspond exactly to a vertical foot and its subdivisions of

which it is a measure. This should be done by means of an ordinary carpenter's square and a spirit level.

It is also very desirable that this form of gage should have its top surface covered with two coats of the best white lead or zinc paint, with the proper figures opposite the even footmarks on the iron strap in black paint and not less than 4 inches in length. Figures should also be burnt in before painting, as permanent markings are thereby secured.

SPECIFICATIONS FOR RIVER GAGE SHOWN IN FIG. 3.

Where a stone pier or abutment is available, a very durable gage can be made by dressing a face, 12 inches in width, from extreme low

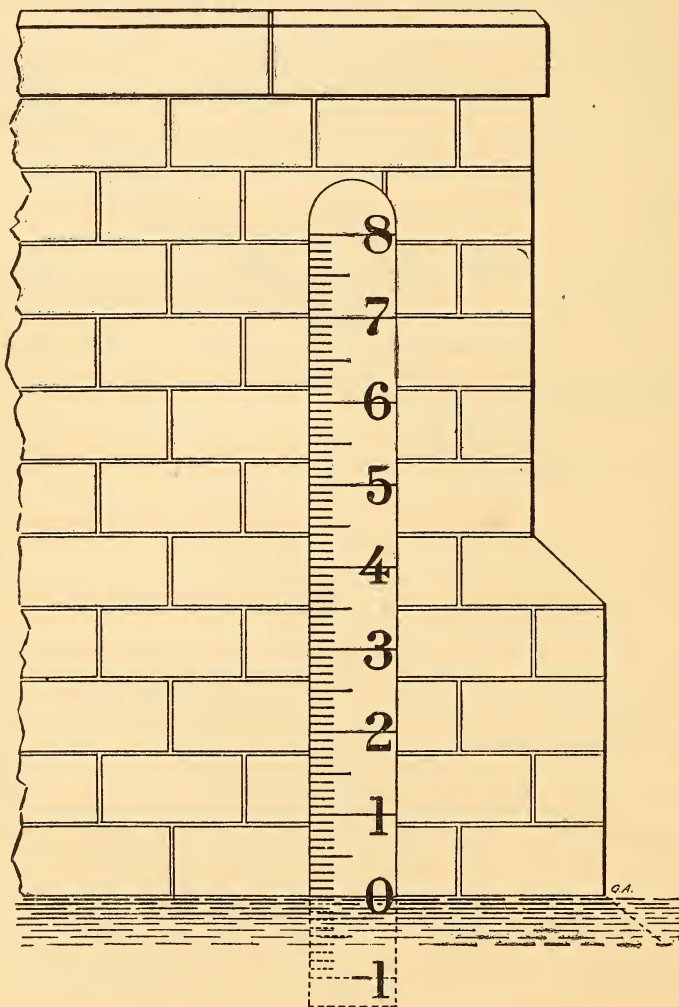


FIG. 3.

water to as far above as may be necessary. The dressed surface should be covered with two coats of the best black paint, preferably asphaltum, after all holes and indentations in the pier have been filled with cement.

The space, both above and below the point at which the zero will be placed, will be graduated with two coats of the best white lead or zinc paint into feet and tenths of feet. Markings for even feet will extend entirely across the gage; those for half feet one-half the way across, beginning on the left side; and those for the intermediate graduations one-quarter of the way across, beginning on the left side. All markings will be one-quarter of an inch in width. The figures for the even foot marks will be in white, 5 inches in height, and the center of each figure must be over the foot line at the right.

SPECIFICATIONS FOR THE CONSTRUCTION AND INSTALLATION OF GAGE-BOXES FOR CHAIN AND WEIGHT RIVER GAGES.

(United States Geological Survey pattern.)

The material, except lumber and paint and heavy bolts, will be furnished by the Weather Bureau.

The box will be made of $\frac{7}{8}$ -inch oak, cypress, or hard pine lumber, planed smooth on both sides, and free from knots and shakes. It will be 15 feet in length, 6 inches in width at the bottom (inside measurement), 6 inches in height on one side and 4 inches on the other. The top will be fastened to the 4-inch side by 6-inch hinges, the hinges being secured by $1\frac{1}{4}$ -inch tire bolts and clamped inside the box with washers and nuts. The hinges will be placed one at each end of the box and also at intervals of 3 feet, making 6 hinges in all. They will be bent around the bottom of the box so that the lower screw bolt of each can be driven into the box from the under side. A hasp and staple will be attached to the middle of the box in the usual manner, using $1\frac{1}{4}$ -inch tire bolts. The lock will be attached with a staple or clamp that can be clinched inside the box.

The pulley will be mounted on the 6-inch side of the box, as shown in diagram attached, and directly below it the bottom of the box will be sawed out.

A slot one-half inch in depth and width will be cut in the middle of the top of the end of the box nearest the pulley. When not in use, the weight can then be drawn up, lifted over the end, and placed in the box, with the chain in the slot. This will admit of the box being securely locked, leaving only a few inches of chain exposed.

The scale will be graduated in feet and tenths of a foot on the 6-inch side of the box (inside), beginning at the inner edge of the pulley frame and ending at the far end of the box. The whole feet will be marked with 2-inch staples, half-foot marks with 1-inch

staples, and intermediate graduations with $\frac{1}{2}$ -inch staples. One staple will be used at each foot and half-foot mark and intermediate graduation. The brass figures for the even feet will then be screwed to the bottom of the box. The scale limits of each will be furnished by the official in charge of the district center. A hook will be provided at the far end of the box to hold the ring secured to the end of the chain.

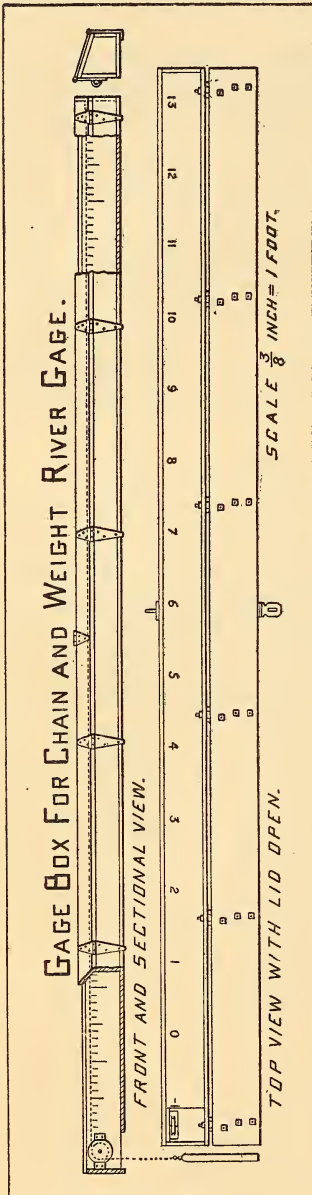


FIG. 4.

these gages, officials in charge of river districts will state the length of sash chain required.

When the zero shall have been established, the weight will be lowered so that its bottom just touches the zero point. The link of the chain directly opposite the zero mark on the scale will then have a rivet driven into it and flattened on both sides so that it will remain firm. Should it be necessary to record river readings beyond the scale limits of the box, the rivet in the chain will be drawn up so that it will be exactly opposite the highest foot mark on the scale. Another rivet will then be driven into that link of the chain exactly opposite the zero mark on the scale, and readings taken using this second rivet as a base. A third rivet can also be added if necessary. In recording readings which are beyond the scale limits of the box, the second rivet will be used as a zero mark instead of the first, and there will be added to the observed reading the distance between the rivets, which will correspond to the highest reading on the scale.

The box will be securely attached by its 6-inch side to the guard-rail or side of bridge, the former preferred.

The whole box will be painted with two coats of best white lead or zinc paint.

In making requisition for material for

DESCRIPTION OF THE MOTT RIVER GAGE.

Box.—The gage box and doors are constructed of sand-dried oak lumber dressed on all surfaces, $\frac{7}{8}$ -inch stock, and inside dimensions as follows: Height, 18 inches; width, 18 inches; depth, $7\frac{1}{2}$ inches.

Doors.—The box has two doors secured with extension hinges in such manner as to permit the doors to swing back against the sides of the galvanized-iron box. The entire outside surface of the box, excepting the bottom, and including the doors, is covered with No. 24 galvanized iron. The joints of the galvanized-iron cover are lapped and soldered, making the cover water-tight. The galvanized-iron cover of the box is painted with two coats of dark-green mineral paint, with a label on the doors of the box bearing the words "Property U. S. Weather Bureau. Penalty for Interference."

Lock.—The box is fitted with a brass mortise lock, using the same key as is used in the standard padlock for the chain and weight gages of the U. S. Weather Bureau and U. S. Geological Survey.

Mechanism.—The box is fitted with a tape reel consisting of an aluminum brake wheel and a brass spider, mounted on a turned cast-iron standard and fitted with a wooden handle. A leather brake strap and suitable levers for releasing the brake are provided. The brake strap is attached to a brass coil spring of sufficient strength to hold the weight and tape in any position. An iron guide wheel running on a turned axle, secured in the box by a cast-iron standard, is also provided.

Tape and gage.—The tape is made of phosphor-bronze, $\frac{1}{80}$ inch in thickness and $\frac{1}{4}$ inch in width. It is nicked throughout, excepting the relief in which the figures are etched, which is plain. The tape, accurately subdivided to feet, with foot marks numbered consecutively between such limits as may be necessary, is furnished with each gage. A 1-foot scale divided into 100 parts, and having every fifth division mark suitably numbered, is placed in the box so as to stand cornerwise back of the tape in a vertical position. This scale is made of No. 16-gage iron, enameled in black and white with six coats of enamel, and is attached to an iron bar which projects upward through the top of the box, the projecting end being covered by a cast-iron cap or cover attached to the box by screws, the object being to provide a suitable bench or reference mark outside the box.

The 1-foot scale is adjustable vertically. A standard weight of the pattern used by the U. S. Weather Bureau and the U. S. Geological Survey is provided with each gage together with a clip and wire for attaching the same to the tape. The gage weight is painted with two coats of white enamel paint.

Miscellaneous.—Each gage contains a covered compartment for the observer's record card, etc., instructions for erecting a gage in various

positions, for attaching the weight, checking the gage datum, and operating the gage.

A rectangular wooden down spout, 16 inches in length, with screw for attaching the same, is provided with each gage.

Each gage is also provided with a screw-driver and a $\frac{3}{8}$ -inch twist drill for use in erecting the gage.

Operation.—Release brake and slowly unwind tape until weight reaches water. Do not run tape all out without holding reel handle. Brake will hold reel in position, and observer can stand to one side to see that tip of weight just touches water. Read number of even feet on bronze tape and tenths of a foot on enameled scale. The figure on the tape standing opposite some part of the 1-foot scale gives the whole feet; the number of tenths and hundredths on the 1-foot scale opposite the index of the number on the tape gives the decimal or fractional portion of the gage reading.

For example, if the number 7 on the tape stands opposite 60 on the enameled scale, the gage reading would be 7.6 feet.

Erection.—The gage may be bolted to the hand rail of a bridge, if not liable to interference, one side being fastened to tie bars that extend down to the floor of the bridge. It may also be secured to a platform extending beyond the hand rail, the bottom of the box being on a level with the top of the rail. When there is no hand rail, as on most railroad bridges, the gage may be bolted or secured to vertical bridge members; or it may stand on horizontal bridge chords, or be attached to two sleepers at their ends. In all cases room must be provided for the unobstructed movement of the weight.

Mott gages ready for installation will be supplied from the central office at Washington, D. C., and bids for installation only will be necessary. In each instance the exact distance from the zero stage of the water to the bottom of the support on which the gage box will rest must be furnished.

RAIN GAGE.

EXPOSURE OF RAIN GAGE.

The exposure of the rain gage is a very important matter. The most serious disturbing effect in collecting rainfall is the wind. In blowing against the gage the eddies of wind formed at the top and about the mouth of the gage carry the rain away, so that too little is caught.

Observers will take particular care in selecting a good place for the location of a gage, as the value of the records is sometimes greatly impaired by improper exposure. It is scarcely necessary to say that every precaution should be taken to protect gages from the interference of animals and unauthorized persons. Select, if possible, a position in some open lot as unobstructed as possible by trees,

buildings, or fences. Such a place in general affords the best exposure. Gages should be exposed upon roofs of buildings only when necessary, and then the roof should be flat, or nearly so. The middle portion of a flat unobstructed roof generally gives the best results.

Rain gages in slightly different positions differ greatly in the depth of rain indicated. Within a few yards of each other two gages may show a difference of 20 per cent in the rainfall in a heavy rainstorm. The stronger the wind the greater the difference is apt to be. In a high location eddies of wind produced by walls of buildings divert rain that would otherwise fall in the gage. A gage near the edge of the roof, on the windward side of a building, shows a less rainfall than one in the center of the roof. The vertical ascending current alongside of the wall extends slightly above the level of the roof, and part of the rain is carried away from the gage. In the center of a large flat roof, at least 60 feet square, the rainfall collected by a gage does not differ materially from what is collected at the level of the ground. A rain gage mounted on a mast at the height of 43 feet collects only 0.75 as much as at the ground; at 85 feet, only 0.64; and at 194 feet, only 0.58. A gage on a plain with a fence 3 feet high around it at a distance of 3 feet will collect 6 per cent more rain than without the fence. These differences are due entirely to wind currents. Forests intercept from 6 to 15 per cent of the rainfall in different rainstorms.

INSTRUCTIONS FOR THE USE OF THE RAIN GAGE.

Description of gage.—The rain gage consists of the following parts: The receiver *A*; the overflow attachment *B*; the measuring tube *C*.

The top cylindrical portion of the receiver, marked *a* in fig. 5, is exactly 8 inches in diameter, inside, and is provided with a funnel-shaped bottom, which conducts any precipitation falling into the receiver into the tall cylindrical measuring tube *C*, the total height of which, inside, is exactly 20 inches. The diameter of this tube is much smaller than the large receiving tube *a*, being only 2.53 inches. In consequence of this a small amount of rain falling into the receiver and flowing into *C* fills the latter to a depth greater than the actual rainfall in proportion as the area of the receiver is greater than the area of the measuring tube. In the standard gages of the Weather Bureau the depth of the rainfall, in accordance with this principle, is magnified just ten times. The receiver *A* has a sleeve *d*, fig. 5, which slips over the tube *C*, and very effectually prevents any loss of rainfall. Again, when the rainfall is very heavy the tube *C* may be more than filled. In this case, to still prevent loss, a little opening, shown at *e*, fig. 5, is made in the sleeve *d*, just on a level with the top of the tube *C*.

The excess of rainfall escapes through this opening, and is retained in the large overflow attachment *B*, and can be measured afterwards, as will be described below. The diameter of the overflow attachment in the latest style gages is now made just 8 inches inside diameter. The object of this is to be able to use this portion of the instrument as a snow gage, as will be explained hereinafter.

RAIN GAGE AND SUPPORT.

The box in which the gage is shipped to the observer is expressly designed as a stand for the instrument, and should be opened at the

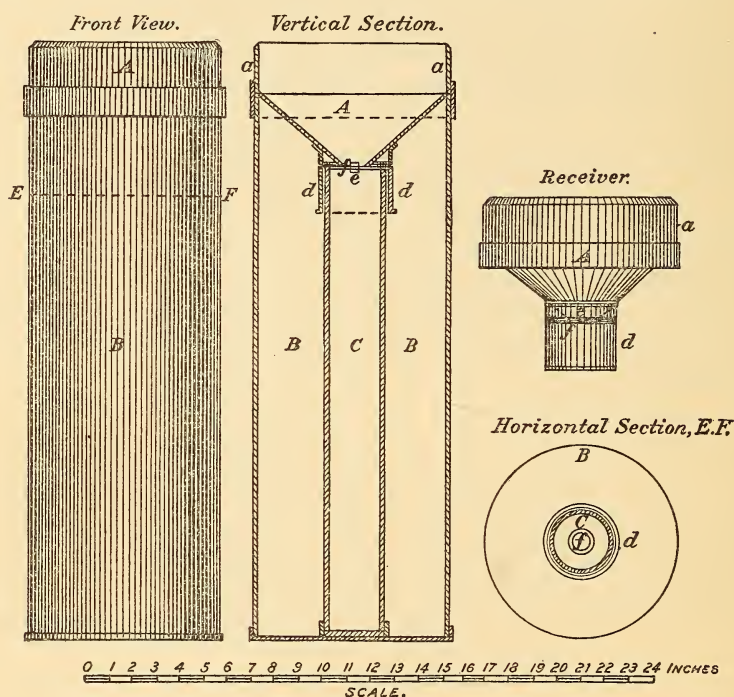


FIG. 5.—RAIN GAGE.

head, which is fastened by screws. Set the box up as nearly vertical as possible at the place selected for the exposure, and secure it in this position by driving down four stakes alongside, in the manner indicated in fig. 6. Care must be taken to have the gage in a truly vertical position. Slip in the head and lower it to the level of the screw holes in the sides of the box about 10 inches from the bottom, where the head will be securely fastened with the screws taken out in opening the box. The gage can now be placed inside, and appears as shown in fig. 6.

TO MEASURE RAINFALL AND SNOWFALL.

RAINFALL.

The rain-gage measuring stick is graduated into inches and tenths of inches. Remembering that the actual depth of the rainfall is magnified ten times, as explained above, it is plain that if we find the water 10 inches deep in the measuring tube, the real rainfall must have been only 1 inch deep; or, if the water in the tube is only one-tenth inch (or, written as a decimal, 0.1 inch deep), the rainfall must have been only one one-hundredth inch (or, written as a decimal, 0.01 inch).

To save observers the trouble of always thinking about the magnification, and to avoid possible errors in reports, the numbers on the graduations of the measuring sticks are not actual inches, but have all been divided by 10, and thus represent the actual rainfall. Moreover, these numbers are expressed in hundredths of inches of rainfall, and are written as decimal fractions. Thus the 10-inch line is numbered 1.00 (read one and zero hundredths), which is the depth of rainfall in inches corresponding to 10 inches of water in the measuring tube; similarly the 1-inch line is numbered 0.10 (read ten one-hundredths), which again is the depth of rainfall in inches corresponding to 1 inch of water in the tube.

The depth of the water is measured by inserting the measuring stick into the gage through the small hole in the funnel. When the stick reaches the bottom of the measuring tube it should be held for one or two seconds and then quickly withdrawn and examined to see at what division of the graduation the top of the wetted portion comes. The numbering of this division, *as stamped on the stick*, gives, as has just been explained, the actual depth of rainfall, and in making out records and reports observers should *always use the decimal expressions*. Of course, it will rarely happen that the top of the wetted portion will fall exactly upon one of the numbered lines—it will generally be on or near one of the shortest lines. Thus, for example, suppose the watermark comes to the sixth short line beyond the line

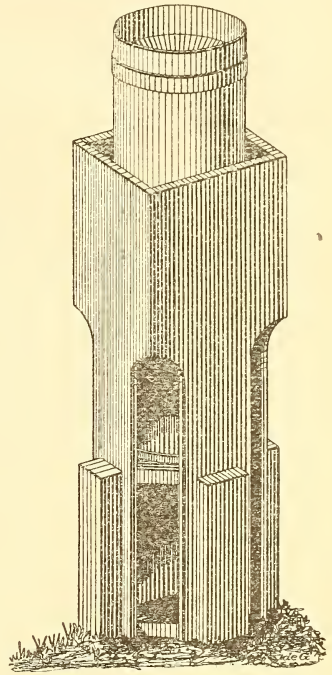


FIG. 6.—RAIN GAGE AND SUPPORT.

numbered .80, the proper record to make in this case would be 0.86-inch rainfall. The number of short lines, reckoned from the numbered line next lower, are always to be inserted in place of the 0 in the stamped numbers.

Observers should always be careful to put the stick into the gage so that the end at which the numbering begins goes to the bottom, and the stick passes through the middle of the tube; for if the stick is placed near the sides the water is sometimes drawn up by capillary action into the narrow space between the stick and the tube, so as to wet the former entirely too high and give very erroneous records.

After measuring and recording in this way the precipitation found in the gage the top should be removed, the measuring tube emptied and drained, and the gage put in position again. Observers should be careful after emptying the gage to replace the measuring tube so that the bottom stands within the ring in the middle of the bottom of the overflow, and in putting on the receiver that it passes over the measuring tube and rests squarely down upon the overflow.

When the amount of rain that has fallen more than fills the measuring tube, some care is required to determine the total rainfall. First, carefully remove the receiver so as not to spill any of the water in the measuring tube, which should be exactly full. If some water has been slopped out and the measuring tube is not exactly full, the amount of water remaining must be accurately measured with the stick as already described. The tube is then lifted out slowly and carefully, if full, so as not to spill any of the water into the overflow, emptied, and allowed to drain a moment or so. The water remaining in the overflow is now poured into the measuring tube, being careful not to lose any, and measured in the usual way. Suppose we find this to be 0.47 inch rainfall, then, remembering that the measuring tube is just 20 inches high, the total rainfall will be 2 inches plus 0.47 inch = 2.47 inches. Or, in case some water was spilled from the measuring tube, the 0.47 inch should be simply added to the first measured amount to give the total rainfall.

SNOWFALL.

During the winter season, especially in those climates where the precipitation is nearly all in the form of snow, it is necessary to expose only the overflow attachment in the support as a snow gage, removing the receiver and measuring tube to the house, as these parts can not be used for measuring snow, and even if rain should occur it is very apt to be frozen while in the measuring tube, generally bursting it and rendering it worthless or highly inaccurate.

First method.—The snowfall collected in the overflow attachment is measured by first placing the vessel in a warm room until the snow is

melted. The water is then carefully poured into the measuring tube and measured just as though it were rainfall.

Second method.—The above method is objectionable because it often requires considerable time and is liable to be inaccurate owing to the loss of the snow or water by evaporation. The following plan is much better, unless clumsily conducted so as to spill and waste the water: Take the overflow into the room and pour into it, carefully, *one measuring tube full to the brim* with water, preferably warm water. This in general will mostly melt, or at least reduce to a very fluid slush a considerable snowfall. The measuring tube should be again carefully filled to the brim from the melted contents of the overflow and emptied, whereupon the remaining water in the overflow should be carefully measured in the measuring tube, thus giving quickly and easily the depth of melted snow.

The amount of snow collected in the overflow of the rain gage is likely to be greatly deficient when the wind blows during the snowfall. In such cases it will be much better if the observer will discard the snowfall in the overflow, empty it out, and cut out a normal section of the snow in an open place where it has neither drifted nor blown away. This section is to be taken by plunging the empty overflow mouth downward in the snow, so as to cut out a cylindrical portion the size of the overflow and the depth of the snow. By the use of a thin board or other means it will not be difficult to gather up the complete section of snow inside the overflow, after which it should be reduced to slush and measured, as already explained.

In addition to this measurement by the gage a measurement will be made of the actual depth in inches of the snow on the ground. Select a level place of some extent, where the drifting is least pronounced, and measure the snow in at least three places. The mean of these measurements will give the snowfall, which is to be entered in the column of the report headed "Depth of snowfall in inches," and whenever it is impracticable to melt the snow as described in the preceding paragraphs, one-tenth of this mean will give an approximate value, in water, for the snow which could not be melted. This value must be set down in the proper column of the report in precisely the same manner as rainfall, or snow melted in the gage. After having once made a measurement of the snowfall it is not desired that the same snow be measured at each succeeding observation until it shall finally disappear. Any fresh snow, however, should be measured and recorded as it falls.

Observations of rainfall should be made at the time of river observations, and the gage should be emptied of all the water it may contain as soon as it has been measured.

If no rain, snow, or hail has fallen during the period of observation make the entry .00 in the proper column. If the amount is too small to measure, make the entry "Trace" or "T."

It is particularly important in the interests of accuracy that the observations be recorded as soon as made, and that the daily entries be made each day. Even if no rain has fallen, the observer should bear in mind that his official record of that fact is very important.

RECORDING OBSERVATIONS.

Form 1006, Met'l.—The record of the observations made at the station for the month, and should be filled up in accordance with the instructions printed on the back of the form.

The form should be mailed to the official in charge of the district center on the first day of the succeeding month.

Before mailing, a copy must be made by the observer in the book furnished for that purpose.

Form 3069, Tel.—For telegraphing reports in accordance with instructions hereinafter given.

Form 1084, Met'l (postal card).—For reporting the daily observations to the official in charge of district center or to other officials when specially authorized.

Form 1049, Met'l (postal card).—For reporting the record of the stage of water in the river for the month, to the Chief, U. S. Weather Bureau, Washington, D. C. This is the *original record* of river stages.

PROPERTY.

When property and supplies are furnished to an observer, an itemized receipt therefor will be immediately mailed to the official in charge of the district.

When an observer is relieved from charge of a station, he will make out a list in triplicate of all Government property in his possession, and append at the bottom thereof the following certificate:

(Date) ———, 19—.

I certify that I have this day received from ——— (name of former observer)
the above-mentioned articles in good condition unless otherwise specified hereon.
(Name of new observer) ———.

One copy of this report will be mailed to the official in charge of the district, one given to the new observer, and the third retained by the retiring observer.

When from any cause any article of property becomes unserviceable or in need of repairs, the fact must be at once communicated to the official in charge of the district for such action as he may deem proper and necessary.

The Chief of the Weather Bureau reserves the right to withhold payment from any person who persistently neglects to make his reports accurately and forward them promptly. Payment will be made quarterly.

REPORTS, WHEN TELEGRAPHED.

The telegraphic reports must be sent as soon as possible after the observation is taken.

Some river observers, when specially instructed, telegraph daily stages to the district center, others only when the river reaches a certain height on the gage, and still others when the water is near, at, or above the flood stage.

In all cases, however, when the rainfall in the past twenty-four hours equals or exceeds 1 inch (or less in special cases), the observer will take a reading of the river gage and telegraph it, together with the amount of precipitation, direction of wind, and state of weather at the time of observation, to the official in charge of the district center.

Telegrams concerning the formation or breaking up of ice gorges, of heavy drift, or other obstructions in the river, when of sufficient extent to endanger navigation or destroy property, will be sent to the district centers and places specially authorized. The telegrams should give, in as few words as possible, the location and extent of the dam or obstruction.

Observers will not prepay telegrams on official business, as settlement will be made by the Washington Central Office direct with the telegraph companies sending the reports.

TELEGRAPHING REPORTS.

It is usually required that telegraphic reports of river stages, etc., be made in cipher. This is for the purpose of saving expense in the transmission of messages.

The cipher accompanying these instructions will be used in telegraphing reports.

When the river is rising at the time of observation, use the cipher words in the column headed "Rising;" when falling, those headed "Falling."

The rising or falling words will be used by the observer in enciphering the stage according to the information available at the time of observation, as to whether the river is rising or falling. This may be ascertained from any noticeable water marks indicating a rise or a fall, or from any special observation made since the last regular a. m. observation. When there is no special knowledge as to whether the river is rising or falling at the time of observation the code word selected to be sent will indicate rising or falling, according as it may

be shown to be by comparison with the previous day's observation at 8 a. m.

The rising or falling feature of a river is especially important at the high stages when the crest of a flood wave is approaching.

The cipher words should be carefully and legibly written in letters that can not be misunderstood.

Observers are advised to write messages, whenever possible, in print letters instead of a running hand. Where written in a running hand the letter "n," wherever it occurs in the message, should be underscored thus n. This is a device for distinguishing "n" from "u" where it is a matter of importance. Care should be taken to so make the script or running-hand letters that an "o" may not be mistaken for an "a," a "t" for an "l," an "i" for an "e," and so on.

When there is difficulty experienced in translating a cipher message at a district center, or when the stage is apparently wrong or inconsistent with observations at other places, caused by careless writing of the message, the observer may be required by a special message from the district center to send the stage in plain words. In such a case the message must contain the stage of the river in plain words; as, for instance, "forty-five six" for forty-five feet six tenths. In such message no wind direction, state of weather, or rainfall will be sent.

One copy of the telegram will be given to the operator at the telegraph office and a copy retained by the observer.

Messages should be filed at the telegraph office as soon as practicable after the observation has been taken.

Reports for telegraphic transmission will be enciphered on Form 3069, as follows: The first space will contain the word "observer;" the second, the name of the place to which the report is to be telegraphed; the third, the name of the station from which the report is telegraphed; the fourth, the cipher word for the date and time of the report; the fifth, the word to indicate the direction of wind and state of weather; the sixth, the word for the stage of water; the seventh, the depth of rainfall; the eighth, the depth of unmelted snow in inches, and the ninth, the surname of the observer sending the report. If there is no snow on the ground, the name of the observer will go in the eighth space. If no rain or snow has fallen, the name will go in the seventh space.

The following is an example of an enciphered report, with the translation. The water is above the zero of the gage and the ground covered with snow.

[Form No. 3069, Tel.]

U. S. DEPARTMENT OF AGRICULTURE, WEATHER BUREAU.

Telegraphic cipher report of observations.

[Observation taken at Clinton, Tenn., on March 1, 1901, at 8 a. m.]

1 Observer	2 Chattanooga —	3 Clinton — —	4 Baby	5 Sing —	6 Saddens —
7 Humpty	8 Ten —	9 Jones —	10		

Received at ———.

———, 19—.

Sent at ———.

———,
Observer.———,
Operator.

* NOTE.—Operators will send only the matter inside the heavy lines, without address or signature. Full instructions for the preparation of this report will be found in the "Weather Code," and on the back of this form. The letter "n" is underscored to distinguish it from "u."

Translation.

Observer, Chattanooga....Address of Weather Bureau observer at Chattanooga, Tenn.

Clinton.....Name of river station at Clinton, Tenn.

Baby.....{ Date of report, first day of the month.
Time of observation (75th meridian), 8 a. m.Sing.....{ State of weather, rain.
Direction of wind, northwest.Saddens.....{ Stage of water in the river, 12.5 feet.
River rising.

Humpty.....Amount of rainfall, 0.01 of an inch.

Ten.....Depth of unmelted snow on the ground, 10 inches.

Jones.....Name of river observer.

The following is an example of an enciphered report, followed by the translation, when the river is below the zero of the gage and there is no snow on the ground:

[Form No. 3069, Tel.]

U. S. DEPARTMENT OF AGRICULTURE, WEATHER BUREAU.

Telegraphic cipher report of observations.

[Observation taken at Helena, Ark., on April 20, 1901, at 8 a. m.]

1 Observer	2 Memphis	3 Helena	4 Bear	5 Rush	6 Pedometer
7 Brown —	8	9	10		

Received at ———.

———, 19—.

Sent at ———.

———,
Observer.———,
Operator.

NOTE.—Operators will send only the matter inside the heavy lines, without address or signature. Full instructions for the preparation of this report will be found in the "Weather Code," and on the back of this form. The letter "n" is underscored to distinguish it from "u."

Translation.

Observer, Memphis.....	Address of Weather Bureau observer at Memphis, Tenn.
Helena.....	Name of river station at Helena, Ark.
Bear.....	{ Date, twentieth day of the month. Time of observation (75th meridian time), 8 a. m.
Rush.....	{ State of weather, cloudless. Direction of wind, west.
Pedometer.....	{ Height of water below zero of gage, 2.8 feet. River falling.
Brown.....	Name of river observer at Helena.

TABLE FOR CONVERTING INCHES INTO TENTHS OF A FOOT.

If the river gage is graduated in feet and inches, the inches will be converted into tenths of a foot by the following table before enciphering for telegraphing:

1 inch of water equals one-tenth (0.1) of a foot.
2 inches of water equal two-tenths (0.2) of a foot.
3 inches of water equal three-tenths (0.3) of a foot.
4 inches of water equal three-tenths (0.3) of a foot.
5 inches of water equal four-tenths (0.4) of a foot.
6 inches of water equal five-tenths (0.5) of a foot.
7 inches of water equal six-tenths (0.6) of a foot.
8 inches of water equal seven-tenths (0.7) of a foot.
9 inches of water equal eight-tenths (0.8) of a foot.
10 inches of water equal eight-tenths (0.8) of a foot.
11 inches of water equal nine-tenths (0.9) of a foot.

RIVER STAGE CIPHER CODE.

The code consists of about 1,400 words, so arranged that the condition of the river at the time of observation (whether rising or falling) and the stage from 9.9 feet below zero to 60 feet above (*including all the intervening tenths of feet*) can be reported in a single word.

The initial letters indicate the condition (whether rising or falling) of the river at the time of observation; thus words beginning with J or S represent river rising, words beginning with P or T represent river falling.

Words beginning with J or P indicate stages below zero, from one-tenth of a foot to nine feet and nine-tenths, inclusive; those with S or T, *immediately followed by a vowel*, indicate stages from zero to 49.9 feet above, inclusive; those with S or T, *immediately followed by a consonant*, indicate stages from 50 to 59.9 feet above, inclusive.

As the S and T words, in which the initial letter is immediately followed by a vowel, cover a range of from zero to 49.9 feet above, inclusive, it is necessary to indicate the *tens of feet* in those words otherwise than by the initial letters only. This is done by assigning certain values to the first vowel, thus u or y = 0; a = 10; e = 20; i = 30; o = 40; thus words beginning with Su or Tu represent stages less than 10 feet; Sa or Ta, over 10 and less than 20; Se or Te, over 20 and less than 30; Si or Ti, over 30 and less than 40; So and To, over 40 and less than 50.

The *units of feet* are indicated by the first consonant (immediately preceding a vowel) of the *second syllable*, according to the following values, viz: b=01., d=02., f=03., g=04., m=05., n=06., r=07., s=08., t=09. Should the *first consonant* (immediately preceding a vowel) of the *second syllable* be one which has *no value* in the code, that is, it is *not* b, d, f, g, m, n, r, s, or t, it indicates that there are *no units of feet* in that word.

The *tenths of a foot*, in *all words*, are indicated by the *vowel immediately following the consonant which represents the units of feet*. The values assigned to the vowels indicating the tenths of a foot are as follows: u or y=0.0; a=0.2; e=0.4; i=0.6; o=0.8. These values (*in order to indicate the odd tenths of a foot, 0.1, 0.3, 0.5, 0.7, and 0.9*) are subject to the proviso that the *final letter of the word in which any of them occur is not "s"*; if it is, then the value of the significant vowel indicating the tenths of a foot in that particular word is increased by one-tenth. That is to say, words ending in "s" indicate stages in which the tenths of a foot are 0.1, 0.3, 0.5, 0.7, or 0.9, while words ending in any other letter indicate stages in which the tenths of a foot are 0.0, 0.2, 0.4, 0.6, or 0.8, as may be more readily seen from the following table:

Final letter not "s."	Final letter "s."
u or y=0.0;	u or y=0.1;
a=0.2;	a=0.3;
e=0.4;	e=0.5;
i=0.6;	i=0.7;
o=0.8.	o=0.9.

A stage of 60 feet if river is rising is indicated by the word "Sword;" if river is falling, by the word "Twoply." These words, as will be noticed, are arbitrary, that is, they are not formed according to the key.

When the stage is above 60 feet, the word indicating 60 feet, rising or falling, as the case may be, will be sent, *immediately followed* by the word representing the stage in excess of 60 feet which is to be reported; thus a stage of 70 feet rising would be enciphered by two words "Sword"—"Sack;" a stage of 69.9 feet falling would be enciphered "Twoply"—"Tutors."

Should the river become frozen, the word "Frozen" will be added to the next succeeding report only.

The following are examples of the use of the code.

- 0.9 below zero, falling, "Pathos."
- 1.2 below zero, rising, "Jobation."
- 6.0 above zero, falling, "Tunny."
- 9.0 above zero, rising, "Suture."
- 55.3 above zero, falling, "Thomas."
- 58.7 above zero, rising, "Spousings."
- 68.0 above zero, falling, "Twoply"—"Tucksy."
- 75.8 above zero, rising, "Sword"—"Salmon."

The code for precipitation gives a word for each even hundredth of an inch from 0.02 to 4.98, inclusive, and also for 0.01 inch and "trace" (amount too small to measure). When more than 0.01 is measured only the even hundredths will be telegraphed; when the measurement is exactly halfway between two even numbers the lower of the two will be sent.

Example.

0.12 inch, send the word, "Husband."

2.54 inches, send the word, "Helmet."

0.01 inch, send the word, "Humpy."

"Trace," send the word, "Hung."

Should the precipitation exceed 5 inches, the word five, six, or seven, etc. (to indicate the inches), will be entered on Form 3069, Tel., and immediately following the extra hundredths will be enciphered in a regular word. Should exactly 5, 6, 7, or more inches fall use the proper figure and follow with the word for "trace."

Example.

7.30 inches, send the words, "Seven Hurtful."

6.00 inches, send the words, "Six Hung."

CIPHER FOR DATE AND TIME OF REPORT.

Date.	75th meridian time.	3 a. m.	6 a. m.	8 a. m.	10 a. m.	12 m.	1 p. m.	2 p. m.	3 p. m.	5 p. m.	8 p. m.	9 p. m.	12 midnight.	Date.
1	Idea	Dane	Baby	Pace	Sack	Aback	Ugly	Cad	Gab	Each	Mace	Nag	1
2	Idiom	Dare	Back	Pack	Sad	Back	Ultra	Cake	Gage	Eager	Madge	Nail	2
3	Idle	Dark	Bad	Pad	Safe	Abandon	Unbar	Calf	Gain	Eagle	Magi	Nash	3
4	If	Darn	Bag	Pagan	Salt	Abase	Unbid	Cam	Game	Ear	Main	Nave	4
5	Ignite	Dart	Bail	Page	Same	Abash	Unbox	Camp	Gang	Early	Make	Navy	5
6	flex	Dash	Bake	Paint	Sample	Abator	Uncle	Cane	Gap	Earth	Malt	Nay	6
7	Ilad	Date	Bald	Paie	Sand	Abey	Uncut	Cape	Gard	East	Man	Neal	7
8	Ilk	Daub	Balk	Pamp	Sash	Abbot	Undam	Cary	Gas	Eat	Mark	Neap	8
9	Image	Dawn	Balm	Palsy	Sauce	Abduct	Under	Case	Gate	Eaves	Max	Near	9
10	Imagine	Day	Band	Pan	Saw	Abet	Undone	Cash	Gaul	Eden	Maze	Neck	10
11	Imbank	Dead	Bangs	Panel	Say	Abior	Undue	Cat	Gave	Edict	Mean	Ned	11
12	Imbibe	Deal	Bank	Fausy	Scant	Abiding	Unfair	Clew	Gay	Edge	Meek	Nero	12
13	Imbow	Deal	Bar	Pardon	Scale	Abiect	Union	City	Gem	Egg	Meg	Nest	13
14	Imburse	Deaf	Baron	Pass	Sense	Abjure	Unit	Clip	Get	Eke	Mend	New	14
15	Imp	Defy	Base	Pause	Sund	Abile	Unjust	Coal	Gift	Eke	Next	Now	15
16	In	Deit	Basin	Paw	Sex	Abode	Unjoin	Cob	Gild	Elder	Mine	Nice	16
17	Incense	Desk	Bat	Peace	Shade	Abolish	Unlike	Coke	Gin	Elf	Minx	Nick	17
18	Index	Dew	Bath	Peak	Shine	About	Unlike	Cold	Gird	Elk	Moat	Nigh	18
19	India	Dial	Bear	Peg	Shine	About	Unpay	Come	Give	Elope	Mob	Nile	19
20	Indite	Dig	Bear	Pen	Shrub	Above	Unpay	Copy	Glad	Elude	Mood	Nip	20
21	Indorse	Dish	Bed	Felt	Slide	Abridge	Unsafe	Cork	Glen	End	Mope	Nod	21
22	Induce	Dogs	Beg	Pike	Sick	Abroad	Unsay	Cost	Go	Enjoy	Morn	Nook	22
23	Indulge	Dove	Bend	Pin	Sign	Abrupt	Until	Cox	Gone	Enlist	Moss	Noon	23
24	Infant	Dower	Berth	Pit	Silk	Assess	Up	Grab	Good	Envy	Moth	Nor	24
25	Infect	Drag	Best	Pitch	Sin	Abscond	Upas	Crow	Gray	Evade	Nose	Nose	25
26	Infer	Draw	Bet	Plant	Sing	Absence	Upon	Cry	Grin	Even	Mown	Not	26
27	Influx	Drip	Beyv	Plain	Sink	Absent	Upset	Cuba	Grub	Evil	Mud	Noun	27
28	Ink	Drum	Bias	Plow	Skate	Absist	Urge	Cud	Gulf	Exact	Muff	Now	28
29	Insane	Dry	Bide	Plum	Skill	Absorb	Urn	Cup	Gun	Exalt	Mugs	Nude	29
30	Inte	Dual	Bird	Plug	Skunk	Absorb	Use	Cuff	Gust	Exist	Musk	Nut	30
31	Invoke	Duck	Blot	Push	Sting	Abstract	Usher	Cur	Guy	Extol	Myth	Nye	31

CODE FOR DIRECTION OF WIND AND STATE OF WEATHER.

Direction of wind.	State of weather.				
	Clear.	Partly cloudy.	Cloudy.	Rain.	Snow.
Calm	Us	All	Each	Ink	Oak
N.	Bulk	Bank	Beak	Birth	Book
NE.	Duck	Damp	Debt	Dip	Dog
E.	Full	Faith	Few	Fish	Folk
SE.	Guy	Gall	Get	Gig	Gown
S.	My	Mark	Mean	Milk	Moth
SW.	Nut	Nail	Nest	Nick	Nook
W.	Rush	Raw	Rend	Rink	Round
NW.	Sunk	Say	Seek	Sing	Soak

All code words must be distinctly printed.

"Fog," "sleet," "clearing," etc., can be indicated by an extra word.

PRECIPITATION SINCE LAST 8 A. M. REPORT.

T.	Hung	. 70	Hurrying	1. 40	Handgun
. 01	Humpy	. 72	Hurrah	1. 42	Haggard
. 02	Huzzaing	. 74	Hundred	1. 44	Hargett
. 04	Humble	. 76	Hungrily	1. 46	Hanging
. 06	Hulking	. 78	Hydrometer	1. 48	Hagood
. 08	Hullo	. 80	Hussy	1. 50	Halmus
. 10	Humbug	. 82	Hussar	1. 52	Handmaid
. 12	Husband	. 84	Hulsean	1. 54	Hammer
. 14	Huckberry	. 86	Hussite	1. 56	Hamilton
. 16	Hubbite	. 88	Hudson	1. 58	Harmon
. 18	Humbolt	. 90	Hubturn	1. 60	Hagny
. 20	Hurdy	. 92	Hunttable	1. 62	Hannah
. 22	Huldah	. 94	Hunter	1. 64	Harness
. 24	Hurden	. 96	Hunting	1. 66	Hayknife
. 26	Hurdies	. 98	Hutton	1. 68	Hanover
. 28	Hunt dog	1. 00	Hack	1. 70	Harry
. 30	Hurtful	1. 01	Happy	1. 72	Harass
. 32	Huntfarm	1. 02	Harland	1. 74	Harebell
. 34	Hulfere	1. 04	Hamlet	1. 76	Harrison
. 36	Huffish	1. 06	Hacking	1. 78	Harrow
. 38	Hubform	1. 08	Havoc	1. 80	Haysucker
. 40	Huguenot	1. 10	Hapsburg	1. 82	Handsaw
. 42	Hungarian	1. 12	Hatband	1. 84	Hawser
. 44	Hunger	1. 14	Habeas	1. 86	Halfsister
. 46	Hugging	1. 16	Habit	1. 88	Hassock
. 48	Hugo	1. 18	Harbor	1. 90	Haughty
. 50	Humus	1. 20	Handy	1. 92	Hardtack
. 52	Human	1. 22	Haddam	1. 94	Hatter
. 54	Hymen	1. 24	Hayden	1. 96	Halting
. 56	Humidity	1. 26	Harding	1. 98	Hampton
. 58	Hummock	1. 28	Haddock	2. 00	Hen
. 60	Huffsuff	1. 30	Handful	2. 01	Healy
. 62	Hymnal	1. 32	Halfage	2. 02	Helicat
. 64	Hunnewell	1. 34	Hayfever	2. 04	Heaven
. 66	Hunnicut	1. 36	Hadfield	2. 06	Healing
. 68	Hypnotic	1. 38	Hartford	2. 08	Hemlock

Precipitation Since last 8 a. m. Report—Continued.

2. 10	Heartburn	3. 10	Highbuilt	4. 10	Hobby
2. 12	Herbage	3. 12	Highbacked	4. 12	Hogback
2. 14	Herbert	3. 14	Hibernian	4. 14	Hotbed
2. 16	Herbis	3. 16	Hibicus	4. 16	Hornbill
2. 18	Herdboy	3. 18	Highborn	4. 18	Hoboy
2. 20	Hedyle	3. 20	Hindustan	4. 20	Honduras
2. 22	Heyday	3. 22	Hidalgo	4. 22	Hockday
2. 24	Herder	3. 24	Hinder	4. 24	Holder
2. 26	Heading	3. 26	Hiding	4. 26	Hoarding
2. 28	Herndon	3. 28	Hindoo	4. 28	Hoodoo
2. 30	Helpful	3. 30	Highfurled	4. 30	Hodful
2. 32	Headfast	3. 32	Highfalls	4. 32	Holdfast
2. 34	Heifer	3. 34	Highfed	4. 34	Hoofed
2. 36	Headfish	3. 36	Highfinish	4. 36	Hoofing
2. 38	Heathfowl	3. 38	Hillfolk	4. 38	Holdforth
2. 40	Headguide	3. 40	Hindgut	4. 40	Hoggy
2. 42	Hellgate	3. 42	Highgate	4. 42	Howgate
2. 44	Hedge	3. 44	Hinge	4. 44	Hodgen
2. 46	Hedging	3. 46	Higgins	4. 46	Hoggish
2. 48	Hengoose	3. 48	Hipgout	4. 48	Hobgoblin
2. 50	Helmuth	3. 50	Hillmule	4. 50	Hogmullet
2. 52	Helpmate	3. 52	Hickman	4. 52	Hoffman
2. 54	Helmet	3. 54	Highmen	4. 54	Holmes
2. 56	Hermit	3. 56	Hielmite	4. 56	Homily
2. 58	Henmold	3. 58	Hindmost	4. 58	Homo
2. 60	Henny	3. 60	Hinnus	4. 60	Horny
2. 62	Hernando	3. 62	Hinan	4. 62	Hobnail
2. 64	Hennepin	3. 64	Highness	4. 64	Honesty
2. 66	Hernia	3. 66	Hinniate	4. 66	Honied
2. 68	Headnote	3. 68	Hinoid	4. 68	Honor
2. 70	Henry	3. 70	Highrule	4. 70	Hoary
2. 72	Herald	3. 72	Hierarch	4. 72	Horace
2. 74	Hebrew	3. 74	Hired	4. 74	Horehound
2. 76	Herring	3. 76	Hiring	4. 76	Horrid
2. 78	Herod	3. 78	Hidrotic	4. 78	Horror
2. 80	Hersum	3. 80	Hirsute	4. 80	Hotsunk
2. 82	Hearsay	3. 82	Hilsa	4. 82	Hosanna
2. 84	Herself	3. 84	Himself	4. 84	Hose
2. 86	Hesitate	3. 86	Hissing	4. 86	Hosiery
2. 88	Hessomite	3. 88	Highsouled	4. 88	Hobson
2. 90	Hearty	3. 90	Hightuned	4. 90	Hoity
2. 92	Hectare	3. 92	Hightaper	4. 92	Hostage
2. 94	Heater	3. 94	Hinted	4. 94	Hotel
2. 96	Hectic	3. 96	Hinting	4. 96	Hoisting
2. 98	Hectoid	3. 98	History	4. 98	Horton
3. 00	High	4. 00	Hoard		
3. 01	Highly	4. 01	Holy		
3. 02	Highway	4. 02	Holland		
3. 04	Higher	4. 04	Hope		
3. 06	Hillier	4. 06	Hopping		
3. 08	Hickock	4. 08	Hollow		

RIVER REPORT IN FEET AND TENTHS OF A FOOT.

RIVER BELOW ZERO OF GAGE.

Rising.	Stage.	Falling.
Jettons	9.9	Patois
Jawtooth	9.8	Pluto
Jauntiness	9.7	Patients
Jauntily	9.6	Pastime
Jeterus	9.5	Patents
Jester	9.4	Patella
Jacktars	9.3	Potatoes
Junta	9.2	Potash
Jantus	9.1	Patulous
Jetty	9 feet	Putty
Jacksons	8.9	Pinsors
Jimson	8.8	Parson
Jussis	8.7	Passions
Jessica	8.6	Passing
Josephus	8.5	Passes
Jesse	8.4	Pease
Jetsams	8.3	Passages
Jessant	8.2	Passable
Jesuits	8.1	Possums
Jessup	8 feet	Palsy
Jurors	7.9	Pharos
Jerome	7.8	Payroll
Jurists	7.7	Paris
Jeering	7.6	Peril
Jereeds	7.5	Parents
Jeremiah	7.4	Palfrey
Jurats	7.3	Pirates
Jimcrack	7.2	Peerage
Jorums	7.1	Perukes
Jury	7 feet	Perusal
Jannocks	6.9	Panoplies
Juno	6.8	Pinole
Juniors	6.7	Penitents
Janitor	6.6	Peninsula
Justness	6.5	Pines
June	6.4	Panel
Journals	6.3	Panadas
Jonathan	6.2	Panacea
Janus	6.1	Pannus
Jenny	6 feet	Peanut
Jeelmoss	5.9	Pomologists

All code words must be distinctly printed.

Rising.	Stage.	Falling.
Jymold	5.8	Pamona
Jemminess	5.7	Palmipeds
Jasmine	5.6	Palmine
James	5.5	Palmettos
Jimmer	5.4	Palmed
Jumarts	5.3	Pamas
Jamaica	5.2	Penman
Jamuls	5.1	Permites
Jimmy	5 feet	Palmy
Jargons	4.9	Pagodas
Jingo	4.8	Pigot
Joggings	4.7	Peggings
Jiggish	4.6	Pagil
Jiggers	4.5	Pages
Judge	4.4	Pigeon
Jingalls	4.3	Pegassus
Jiggamaree	4.2	Pagan
Jugulates	4.1	Peguins
Jugular	4 feet	Pinguid
Jafords	3.9	Performs
Jailfoil	3.8	Pinfold
Jagfirs	3.7	Pitfishes
Jugfish	3.6	Perfidy
Juffers	3.5	Pilfers
Jefferson	3.4	Perfect
Jeofails	3.3	Pitfalls
Jawfall	3.2	Palmfan
Joyfulness	3.1	Perfumes
Jestful	3 feet	Pailful
Juddocks	2.9	Paddocks
Jibdoor	2.8	Pedometer
Judicious	2.7	Paddings
Jading	2.6	Pedim
Jardes	2.5	Pedestals
Jade	2.4	Pander
Judaists	2.3	Pedals
Judah	2.2	Pindal
Jurdus	2.1	Pindusts
Judy	2 feet	Paducah
Jibbooms	1.9	Pollbooks
Jamboree	1.8	Parboil
Jubilees	1.7	Poebirds
Jobbing	1.6	Paybill

Rising.	Stage.	Falling.
Jibes	1.5	Pallbearers
Jobber	1.4	Pemberton
Jubas	1.3	Pebas
Jobation	1.2	Panbase
Jumbus	1.1	Pabulous
Jewbush	1 foot	Pabulum
Jailors	0.9	Pathos
Jaspoid	0.8	Pappoose
Jerkings	0.7	Palliates
Julian	0.6	Pallid
Javelins	0.5	Pallets
Javel	0.4	Pale
Jalaps	0.3	Pampas
Japan	0.2	Palate
Julus	0.1	Papuans

RIVER ABOVE ZERO OF GAGE.

	Zero	
Sunk	0.1	Tucum
Sulks	0.2	Tusks
Subjacent	0.3	Tuscany
Surpass	0.4	Tuckahoes
Superb	0.5	Turtle
Sublets	0.6	Tumbles
Survive	0.7	Tucking
Suscitates	0.8	Tulips
Suppose	0.9	Turcoman
Subjoins	1 foot	Turcois
Sudbury	1.1	Tubular
Suburbs	1.2	Tubulus
Subastral	1.3	Tubal
Subagents	1.4	Turbans
Subbeadle	1.5	Tube
Sunbeams	1.6	Tuberous
Subinduce	1.7	Turbid
Sunbirds	1.8	Turbidness
Suboval	1.9	Tyboe
Subordinates	2	Turbots
Subduct	2 feet	Turfdum
Subdues	2.1	Turdulis
Sudak	2.2	Tyndall
Sundays	2.3	Tyndarus
Sudden	2.4	Tysdell
Suddenness	2.5	Tydeus
Sundial	2.6	Tundish

Rising.	Stage.	Falling.
Subdivides	2.7	Tuditamus
Sundown	2.8	Tudor
Subdolos	2.9	Tudors
Suffusion	3 feet	Turfy
Suffuses	3.1	Tyfus
Subfamily	3.2	Turfan
Surfaces	3.3	Tuffas
Sufferance	3.4	Turfed
Suffers	3.5	Turfers
Suffix	3.6	Tuficani
Suffices	3.7	Turfings
Suffolk	3.8	Tuffoon
Suffocates	3.9	Tyfoons
Surgy	4 feet	Tuggy
Surguts	4.1	Tunguses
Sugar	4.2	Tugaloo
Sugarless	4.3	Tygart
Suggestion	4.4	Tuggerah
Suggests	4.5	Tuggers
Surging	4.6	Turgid
Suggillates	4.7	Turgidness
Surgo	4.8	Tungo
Sungors	4.9	Turgoils
Summy	5 feet	Tumult
Summus	5.1	Tumulous
Sumatra	5.2	Turnman
Summaries	5.3	Turmalines
Summery	5.4	Tumefy
Summers	5.5	Tumefies
Summit	5.6	Tumid
Summitless	5.7	Tumidness
Summoner	5.8	Tumor
Summons	5.9	Tumorous
Sunnyside	6 feet	Tunny
Sunnus	6.1	Turnus
Sunnapee	6.2	Tunable
Surnames	6.3	Tunas
Sunem	6.4	Turney
Subnects	6.5	Tunnels
Sunning	6.6	Tuning
Sunniness	6.7	Turnips
Subnote	6.8	Turnover
Subnormals	6.9	Turnouts
Surry	7 feet	Turung

Rising.	Stage.	Falling.
Syrups	7.1	Tyrus
Syracuse	7.2	Tyranical
Subtracts	7.3	Tyrants
Surely	7.4	Turret
Sureties	7.5	Tureens
Syria	7.6	Turio
Syringes	7.7	Tyrians
Surrogate	7.8	Tyro
Surrounds	7.9	Tyroness
Subsume	8 feet	Tucksy
Subsultus	8.1	Tursus
Susannah	8.2	Tutsan
Susans	8.3	Tussahs
Sunset	8.4	Tusseiner
Subserves	8.5	Tussers
Subsidence	8.6	Tussicular
Subsides	8.7	Tursins
Subsolarly	8.8	Tussock
Subsoils	8.9	Tysonites
Suture	9 feet	Tufty
Sumptuous	9.1	Tutuillas
Sustainable	9.2	Tutary
Sustains	9.3	Turntables
System	9.4	Tutelary
Subtends	9.5	Tutelages
Subtile	9.6	Tutti
Subtilizes	9.7	Tuitions
Sutton	9.8	Tutoring
Suitors	9.9	Tutors
Say	10 feet	Tally
Salutes	10.1	Talks
Salary	10.2	Tankard
Salads	10.3	Tallages
Save	10.4	Tape
Sales	10.5	Tales
Saline	10.6	Talking
Salivates	10.7	Tapis
Sallow	10.8	Talcoze
Saloons	10.9	Talons
Sabula	11 feet	Tabular
Sabus	11.1	Tabulates
Sabaism	11.2	Tabasco
Sabbaths	11.3	Tabards
Sabellian	11.4	Taber

Rising.	Stage.	Falling.
Sabers	11.5	Tabernacles
Sabianism	11.6	Tabid
Sabines	11.7	Tabidness
Sabot	11.8	Taboo
Samboes	11.9	Taborets
Sandy	12 feet	Tardy
Sadduces	12.1	Tardus
Sadda	12.2	Tardation
Sandals	12.3	Tardacious
Saddest	12.4	Tadde
Saddens	12.5	Tandems
Sandiver	12.6	Tardily
Sardines	12.7	Tardiness
Sardonic	12.8	Tardo
Sadocus	12.9	Tarldons
Safune	13 feet	Taffy
Sackfuls	13.1	Taffys
Safable	13.2	Tafa
Safableness	13.3	Tafallas
Safely	13.4	Tafeta
Safes	13.5	Tafferels
Saltfish	13.6	Tafi
Safies	13.7	Tafias
Sanford	13.8	Tarfork
Sainfoins	13.9	Talfords
Sanguine	14 feet	Taguan
Sanguifies	14.1	Tagus
Sagacity	14.2	Taganet
Sagacious	14.3	Tagals
Sagely	14.4	Tangent
Sageness	14.5	Targets
Saginaw	14.6	Tangible
Saginataes	14.7	Taggins
Sago	14.8	Tagolanda
Sagoins	14.9	Tagouts
Sammy	15 feet	Talmud
Samuels	15.1	Talmudists
Samarcand	15.2	Tamable
Samaritans	15.3	Tamarins
Same	15.4	Tame
Sameness	15.5	Tameness
Samite	15.6	Taming
Salmis	15.7	Tamines
Salmon	15.8	Tamora

Rising.	Stage.	Falling.
Samos	15.9	Tamos
Sanny	16 feet	Tawny
Sannups	16.1	Tannus
Sanable	16.2	Tannate
Sanatives	16.3	Tannahills
Sanely	16.4	Tanned
Saneness	16.5	Tanners
Sanity	16.6	Tannin
Sanions	16.7	Tarnishes
Sanok	16.8	Tarnow
Sannos	16.9	Tapnors
Sary	17 feet	Tarry
Sacrum	17.1	Taurus
Sarah	17.2	Tarrant
Saracens	17.3	Tarragons
Sacred	17.4	Tarred
Sacredness	17.5	Tarentulas
Sacristy	17.6	Tarrier
Sacrifices	17.7	Tariffs
Saffron	17.8	Tagro
Saronis	17.9	Tarrocks
Salsuma	18 feet	Tansy
Satsumas	18.1	Tarsus
Sausage	18.2	Tarsal
Sassafras	18.3	Tarsals
Sasse	18.4	Tasset
Salses	18.5	Tassels
Sassin	18.6	Tassian
Salsifies	18.7	Tasimeters
Samson	18.8	Tasso
Sassorals	18.9	Tasoons
Saturn	19 feet	Tasty
Saturates	19.1	Tartuffes
Satanic	19.2	Tartar
Satanisms	19.3	Tantalus
Salted	19.4	Taste
Satellites	19.5	Tasteless
Satiate	19.6	Tactile
Satisfies	19.7	Tactics
Santon	19.8	Taunton
Sandstones	19.9	Tattoos
Seek	20 feet	Tell
Seals	20.1	Telys
Secant	20.2	Tekamah

Rising.	Stage.	Falling.
Sealarks	20.3	Templars
Select	20.4	Tempest
Sealegs	20.5	Tempestuous
Sealing	20.6	Tepid
Servitudes	20.7	Tellinas
Seahog	20.8	Telotype
Sepoys	20.9	Teapots
Selby	21 feet	Tenby
Seabugs	21.1	Tebbys
Sebate	21.2	Tebal
Sebaceous	21.3	Tebars
Sebesten	21.4	Tebeth
Seabeans	21.5	Tebbes
Seabird	21.6	Tebinal
Sebiferous	21.7	Tebbins
Seaboy	21.8	Teaboard
Seaboards	21.9	Telbons
Seduce	22 feet	Teddy
Sedulous	22.1	Tendums
Sedate	22.2	Tendance
Sedateness	22.3	Tendants
Sedentary	22.4	Tender
Senders	22.5	Tenderness
Sediment	22.6	Tedium
Seditious	22.7	Tedious
Seldom	22.8	Tendo
Seadogs	22.9	Tendons
Seafurth	23 feet	Tearful
Seafurs	23.1	Teamfuls
Sefatian	23.2	Telfair
Serfages	23.3	Tenfans
Seafern	23.4	Termfee
Seafennels	23.5	Terfens
Seafish	23.6	Terfile
Seafights	23.7	Telfis
Seafoam	23.8	Telfort
Seafowls	23.9	Tenfolds
Sedgy	24 feet	Tegular
Seagulls	24.1	Teguments
Segano	24.2	Tergal
Segars	24.3	Tergants
Sedgewick	24.4	Tegellen
Sedges	24.5	Teages
Sedging	24.6	Tergiant

Rising.	Stage.	Falling.
Seagirdles	24.7	Tergites
Seagoing	24.8	Tergo
Seagods	24.9	Tegorskois
Seamy	25 feet	Temulent
Semunies	25.1	Temulences
Selma	25.2	Termagancy
Seamaids	25.3	Termagants
Segment	25.4	Temerity
Seamells	25.5	Temenos
Seeming	25.6	Terminal
Seminates	25.7	Terminates
Semolino	25.8	Teignmouth
Sermons	25.9	Telmos
Senur	26 feet	Tenure
Seanympths	26.1	Tenuous
Senate	26.2	Tenable
Senators	26.3	Tenants
Seine	26.4	Tenet
Seneschals	26.5	Tenements
Senile	26.6	Tenioid
Seniors	26.7	Tennis
Segno	26.8	Tenon
Senoculars	26.9	Tenors
Serum	27 feet	Terry
Serrulates	27.1	Tetrus
Seraphim	27.2	Terrapin
Seraphs	27.3	Terraces
Sebree	27.4	Terrence
Serenades	27.5	Terrets
Serial	27.6	Terrible
Series	27.7	Terrifies
Seabrook	27.8	Tenbrook
Serous	27.9	Terrors
Sensual	28 feet	Tessular
Sensuous	28.1	Tensys
Sensate	28.2	Tefsa
Sensations	28.3	Tensates
Sense	28.4	Tessellate
Senseless	28.5	Tenses
Sensible	28.6	Tensity
Sensibleness	28.7	Tensions
Seasonable	28.8	Telson
Seasons	28.9	Tensors
Setule	29 feet	Testudo

Rising.	Stage.	Falling.
Sextus	29.1	Testuous
Sextant	29.2	Temptation
Setaceous	29.3	Tetanus
Sentence	29.4	Tetter
Settees	29.5	Teamsters
Setting	29.6	Tempting
Sections	29.7	Testifies
Seton	29.8	Teutonic
Sextons	29.9	Teutons
Silly	30 feet	Tip
Silks	30.1	Tillures
Silvan	30.2	Tillable
Sillabubs	30.3	Tillages
Silent	30.4	Tipper
Silenes	30.5	Tiplers
Silicate	30.6	Ticklish
Silliness	30.7	Tippings
Sirloin	30.8	Tivoli
Sillons	30.9	Tillots
Sibyline	31 feet	Tiburon
Sibyls	31.1	Tilburys
Sitzbath	31.2	Timbal
Sinbads	31.3	Tidballs
Siberia	31.4	Tiberg
Siberians	31.5	Tiberius
Sibilation	31.6	Tibial
Sibilants	31.7	Tidbits
Sibboleth	31.8	Tibbo
Signboards	31.9	Timborines
Sidulation	32 feet	Tidy
Sidulates	32.1	Tiduates
Sidacene	32.2	Tidal
Sirdars	32.3	Tindal
Sideral	32.4	Tidesman
Sideways	32.5	Tides
Sindi	32.6	Tidily
Sidings	32.7	Tidings
Sindon	32.8	Tidology
Sidonis	32.9	Tidors
Sinful	33 feet	Tiffy
Sinfulness	33.1	Tightfuls
Sitfast	33.2	Tifano
Sifacs	33.3	Tiffany's
Simfero	33.4	Tifernum

Rising.	Stage.	Falling.
Sifers.....	33.5	Tifersas
Siflet.....	33.6	Tiffish
Siffians.....	33.7	Tiffins
Sixfold.....	33.8	Tilford
Sixfooters.....	33.9	Tinfoils
Singular.....	34 feet	Tigutta
Singultus.....	34.1	Tilgus
Singapore.....	34.2	Tigaria
Singacs.....	34.3	Tiogas
Sigel.....	34.4	Tiger
Singers.....	34.5	Tigellas
Singing.....	34.6	Tingild
Sigils.....	34.7	Tingis
Sigourney.....	34.8	Tiggold
Sigoes.....	34.9	Tibgoats
Sigmund.....	35 feet	Timmy
Simulates.....	35.1	Tilmus
Sigma.....	35.2	Timal
Simars.....	35.3	Tiermas
Simeon.....	35.4	Time
Simmers.....	35.5	Timeless
Similar.....	35.6	Timist
Similes.....	35.7	Timidness
Simony.....	35.8	Timothy
Simoons.....	35.9	Timorous
Sinuate.....	36 feet	Tiny
Sinuuous.....	36.1	Tionus
Signalize.....	36.2	Tinate
Signals.....	36.3	Tinamous
Sidney.....	36.4	Tinnent
Sinners.....	36.5	Tinners
Sinning.....	36.6	Tinning
Signifies.....	36.7	Tinibras
Signor.....	36.8	Tinnock
Sinoples.....	36.9	Tinos
Sirupy.....	37 feet	Tigry
Sirups.....	37.1	Titrucks
Sirrah.....	37.2	Tirano
Sierras.....	37.3	Tirades
Siren.....	37.4	Tired
Sires.....	37.5	Tireless
Siritch.....	37.6	Tiring
Sirius.....	37.7	Tigris
Sirocco.....	37.8	Tiro

Rising.	Stage.	Falling.
Siromus	37.9	Tironians
Sissy	38 feet	Tipsy
Sisyphus	38.1	Tissues
Sisal	38.2	Tirsah
Sisamnes	38.3	Tinsaws
Sipsey	38.4	Tinselly
Sises	38.5	Tinsels
Sinsinawa	38.6	Tipsily
Sissings	38.7	Tipsiness
Simpson	38.8	Tilson
Sissons	38.9	Timsons
Sixty	39 feet	Tincture
Situates	39.1	Titus
Siesta	39.2	Tintag
Siltages	39.3	Titans
Sixteen	39.4	Tighter
Sites	39.5	Tightens
Sistine	39.6	Titilation
Sittings	39.7	Titilates
Sinton	39.8	Tito
Sitones	39.9	Tiptops
Soak	40 feet	Told
Solubles	40.1	Tolus
Solar	40.2	Tokay
Solaces	40.3	Towards
Solemn	40.4	Toledo
Soles	40.5	Tokens
Solitude	40.6	Tokio
Solids	40.7	Topics
Solo	40.8	Tocoa
Solons	40.9	Toponis
Sowbug	41 feet	Toby
Soapbubbles	41.1	Tobusos
Sowbane	41.2	Tobacco
Sorbates	41.3	Tobas
Sober	41.4	Torbert
Soberness	41.5	Tomberlins
Sobieski	41.6	Tombigbee
Sobbings	41.7	Tobias
Soapboil	41.8	Tomboy
Soboles	41.9	Toboggans
Soddy	42 feet	Toady
Sodus	42.1	Toadyisms
Soda	42.2	Tondano

Rising.	Stage.	Falling.
Sodalities	42.3	Toydarts
Sodden	42.4	Todder
Solders	42.5	Toadeaters
Sodium	42.6	Toadish
Soddings	42.7	Toadishness
Sodomy	42.8	Tondorf
Sodomites	42.9	Tondotus
Songful	43 feet	Toyful
Soefuls	43.1	Tofus
Solfa	43.2	Tofano
Sofas	43.3	Tofalls
Sofett	43.4	Toffee
Sofettes	43.5	Tofets
Sofia	43.6	Topfit
Sofisms	43.7	Torfields
Soulfoot	43.8	Tomfoolery
Sorfors	43.9	Tomfools
Soggy	44 feet	Tongue
Solcus	44.1	Tongueless
Sogano	44.2	Togated
Southgates	44.3	Togas
Sogel	44.4	Together
Sogers	44.5	Toggeries
Songish	44.6	Togging
Sogginess	44.7	Toggings
Sorgo	44.8	Tongo
Sogonois	44.9	Torgochs
Solmuth	45 feet	Tommy
Somus	45.1	Tomyris
Somal	45.2	Tomahawk
Somatists	45.3	Tomatoes
Some	45.4	Tormentor
Sortments	45.5	Torments
Somina	45.6	Tomini
Somites	45.7	Tomis
Southmost	45.8	Toulmouche
Solmonas	45.9	Tomoris
Sonny	46 feet	Tournure
Soapnuts	46.1	Tonus
Sonant	46.2	Tonality
Sonatas	46.3	Tonnages
Sooner	46.4	Toned
Sonnets	46.5	Tones
Somnial	46.6	Tonnish

Rising.	Stage.	Falling.
Somnifics	46.7	Tonics
Sonoma	46.8	Tomnoddy
Sonorous	46.9	Tonometers
Sorry	47 feet	Tory
Sorus	47.1	Torus
Sorrance	47.2	Touraco
Socrates	47.3	Torrances
Sorento	47.4	Tore
Soreness	47.5	Torrefies
Sorrily	47.6	Torrid
Sorriness	47.7	Tourists
Sorrowful	47.8	Torosity
Sorrows	47.9	Torones
Sonsy	48 feet	Tonsured
Soapsuds	48.1	Tolsus
Soothsay	48.2	Toussaint
Soothsayers	48.3	Topsails
Souse	48.4	Tossed
Sowses	48.5	Townsend
Sossian	48.6	Tossing
Sousings	48.7	Tonsils
Soso	48.8	Topsole
Soursops	48.9	Towsons
Sooty	49 feet	Torture
Soltuns	49.1	Tortugas
Sontag	49.2	Totality
Soutages	49.3	Totals
Softening	49.4	Tottering
Softens	49.5	Totters
Sottish	49.6	Tortilla
Solstices	49.7	Tortious
Soto	49.8	Tortoise
Soapstones	49.9	Tombstones
Sharply	50 feet	Trimly
Shalus	50.1	Trijugous
Shellac	50.2	Thecal
Stewards	50.3	Thalamus
Skillet	50.4	Thicken
Spotless	50.5	Thankless
Spavin	50.6	Thalian
Stealings	50.7	Thalidans
Shiloh	50.8	Thallogen
Shakos	50.9	Tripods
Stubby	51 feet	Tribune

Rising.	Stage.	Falling.
Strombus	51.1	Tributes
Skimback	51.2	Threadbare
Snowballs	51.3	Thebans
Stuben	51.4	Thibet
Stabbers	51.5	Thibetans
Scrubbing	51.6	Trebizond
Stebbins	51.7	Twibills
Stubborn	51.8	Tribolet
Steamboats	51.9	Trombones
Study	52 feet	Thready
Spondulics	52.1	Traduces
Standard	52.2	Tridactyl
Scandals	52.3	Thursdays
Shadest	52.4	Thunder
Shoulders	52.5	Thunderless
Spalding	52.6	Traditor
Slidings	52.7	Traditions
Shaddock	52.8	Theodoric
Shadows	52.9	Theodolites
Skillful	53 feet	Thankful
Spoonfuls	53.1	Transfuses
Stefano	53.2	Trafalgar
Shroffages	53.3	Trifallows
Strife	53.4	Transferring
Snuffers	53.5	Transfers
Starfish	53.6	Transfix
Spearfishes	53.7	Traffics
Stafford	53.8	Trefoil
Scaffolds	53.9	Transforms
Spongy	54 feet	Triangular
Shoguns	54.1	Tragus
Slogan	54.2	Tragacanth
Sluggards	54.3	Tragalisms
Sturgeon	54.4	Tragedy
Strangers	54.5	Tragedians
Staging	54.6	Tragic
Sluggings	54.7	Tragicalness
Strigon	54.8	Trigonal
Slangous	54.9	Trigonous
Slimy	55 feet	Tremulant
Sloomus	55.1	Tremulous
Stigma	55.2	Thermal
Stomachs	55.3	Thomas
Stamen	55.4	Trammel

Spin	57.6	
Stories	57.7	Theorizes
Spiroscope	57.8	Thorough
Sparrows	57.9	Tharos
Scissum	58 feet	Treasury
Scissures	58.1	Thapsus
Spousage	58.2	Thessaly
Spousals	58.3	Thousands
Stansell	58.4	Thyself
Spouses	58.5	Trisects
Scissible	58.6	Transit
Spousings	58.7	Thesis
Slawson	58.8	Transom
Scissors	58.9	Treasons
Statute	59 feet	Treaty
Status	59.1	Treatures
Sprigtail	59.2	Tractable
Spartans	59.3	Tractators
Spatter	59.4	Twister
Shooters	59.5	Trustees
Shooting	59.6	Thirtieth
Stations	59.7	Treatings
Stanton	59.8	Tractory
Swintons	59.9	Traitors
Sword	60.0	Twoply

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